Wages as Income but also as a Cost of Production: An Amended Neo-Kaleckian Short-Run Model

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Abstract. While orthodox economists consider wages as costs but neglect their role as incomes, post-Keynesians consider wages as incomes but neglect their role as costs. Actually, high labor costs never directly deter firms from increasing their production, even in all the many models of income distribution in which the effect is indirect, going through the aggregate demand components. The aim of this article is to take into account both features of wages: as incomes, but also as costs. Accordingly, we explore the properties of a neo-Kaleckian model that includes two specific assumptions: the labor productivity differs from one firm to another, and production must be profitable. In such framework, the demand regime remains wage-led as long as the price level is higher than the macroeconomic break-even point. Under the break-even point, however, the economy reacts as if it were profit-led: a rise in the real wage fuels the aggregate demand (wage-led demand regime), but firms decide to reduce output because of a cut in their profitability on the least efficient equipment.

Key words: Labor cost, Income distribution, Wage-led model, Break-even point.

JEL codes: E12, E20, E23

1. Introduction

Orthodox economists consider wages as costs but neglect their role as incomes. According to Keynesian economists, this assertion constitutes a rebuke: the economic analysis is distorted because of the omission of central assumptions in the orthodox approach. However, we have to admit that this argument can easily be reversed,

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pointing that post-Keynesians consider wages as incomes but neglect their role as costs. It is particularly evident in all the many post-Keynesian models in which income distribution affects the economic activity through the level of aggregate demand. In these models, the demand regime is wage or profit-led depending on whether a rise in wages fuels or stifles the production via its effect on the aggregate demand components (consumption, investment, net exports). In orthodox theory, production depends on profitability whereas it depends on aggregate demand in the post-Keynesian theory in which labor costs never deter firms from increasing their production.

I am convinced that an effort must be made in order to combine the two approaches (wages both as income and as a cost of production) in a single model. One reason is that the orthodox argument is powerful. It cannot simply be ignored while many managers repeat every day that they would hire more workers if labor costs were lower. Many people (including politician) are persuaded by this reasoning. They are very skeptical when an alternative analysis is proposed, some of them listening politely but shrugging and turning on their heels, as they understand that the labor costs argument is omitted. Therefore, the combination of the two approaches in a single framework could make the demand-led approach more convincing to skeptics.

In addition to this rhetorical goal, there is of course a theoretical one. After all, there is perhaps something right in the orthodox and managers' claim. Taking it in consideration in a post-Keynesian approach could allow a better comprehension of macroeconomic consequences of a change in the income distribution.

In this perspective, the aim of this article is to explore the properties of an amended canonical neo-Kaleckian model in which labor costs can deter some firms to respond to the demand of goods.

To my knowledge, this possibility is not taken into account in the existing post-Keynesian literature since the rejection of diminishing returns in favor of the assumption of constant marginal costs. My purpose is not to question this rejection at a microeconomic level: according to Eicher (1976) and many others, marginal costs can be supposed to be constant at the firm (or plant, or plant segment) level. However, what is questionable is the generalization for the economy as a whole. It is sufficient to assume that firms differ in their efficiency to restore diminishing returns (or increasing marginal costs) at the macroeconomic level. This is what is done here assuming an embodied technical progress so that the capital stock is composed by equipment of different vintages.

Moreover, if we assume that all firms face both the same price level and the same monetary wage, they will differ in regard of their rate of mark-up, which can become negative. It will be then supposed that firms do not produce if they are confronted to a negative mark-up.

According to these assumptions, the demand regime remains wage-led for low levels of real wage: a wage increase implies a rise in aggregate demand leading to an increase of the rate of capacity utilization. However, the increase in capacity utilization goes with the use of less efficient equipment, which generates lower rates of mark-up. Yet there comes a time where the additional increases in the wage rate imply negative mark-ups on the marginal equipment. Firms then do not respond to the demand of goods if it is not profitable. As a result, any real wage increase is combined with a decrease in the rate of capacity utilization. The model somehow becomes profit-led, but not in a post-Keynesian way since the demand regime remains wage-led.

At this stage, the goods market is not balanced since it is subject to a demand excess. This disequilibrium can easily be solved in the short run, assuming inventories depletion as well as investment or consumption rationing. However, the long-run adjustment must be based on alternative mechanisms, such as endogenous modifications in the savings or investment behaviors. The analysis of these long-run adjustments that is provided below is not fully convincing. It will clearly deserve more attention in further research.

The model assumptions are presented in Section 2 while Section 3 is devoted to the model resolution. Section 4 provides a short conclusion.

2. Model assumptions

We propose a canonical, neo-Kaleckian model with the usual investment and savings behaviors. We introduce three innovations concerning labor productivity, price setting and production behavior. As it will be made clear, the first two are fully consistent with a post-Keynesian approach. The third can be inferred from the preceding ones.

2.1. Labor productivity at the macroeconomic level

After the Cambridge controversies in capital theory, most post-Keynesians reject the neoclassical assumption of diminishing returns. They adopt fixed technical coefficients of production instead, i.e. a production function *à la* Leontief with a constant marginal productivity of labor (q) up to full capacity. Assuming no capital shortage, the production function (Q) is given by:

$$Q = qL = uK, \tag{1}$$

where L and K correspond to labor input and capital stock respectively, and u to the endogenous current utilization rate of capacity.

This specification is legitimated by several case studies in firms, plants or even plant segments. For instance, Eichner (1976) describes megacorps as firms characterized by "a number of smaller producing units, called plants or plant segments, and that within each of these smaller producing units the proportion of capital equipment, laboring manpower and other inputs required to turn out the final product cannot, as a practical matter, be altered in the short run" (p. 28). Marginal costs are therefore constant. Eichner (1976, p. 34-35) also considered the possibility of rising marginal costs if the firm is composed by plants (or plant segments) that differ in efficiency, but he quickly neglects this case arguing that "the differences are not likely to be very great — or else the megacorp will certainly take steps to eliminate them". Finally, despite some criticisms,[2] the assumption of constant marginal costs at the firm level has been adopted by most post-Keynesians.

However, it is one thing to assume constant marginal productivity at the firm level, but it is another to generalize this assumption for the economy as a whole. Yet this is what is usually done, particularly in the models dealing with income distribution. On the contrary, we assume that the economy is composed by plants and firms whose efficiency significantly differs.[3] As a result, the aggregation of firms with constant marginal costs

[2] See the debate between Lee (1986) who criticizes the assumption of constant marginal costs at the microeconomic level, and Yordon (1987) who defends Eichner's view.

[3] This assumption is supported, for instance, by Lee's (1986, p.408-9) remarks about technical progress and costs. See also Davidson's (1960, p.52-3) reference to Reder (1952) who develops the following argument: "Suppose that all firms had marginal cost curves that were horizontal (up to capacity), but that the vertical intercepts of the marginal cost curves of some

produces rising marginal costs at the macroeconomic level. Such hypothesis enhances the model's realism, especially if embodied technical progress generates greater labor productivity on new equipment.

At the firm level, the coexistence of equipment of different vintages could be depicted by a step function. At the macroeconomic level, however, this step function can be transformed in a continuous, differentiable function. Moreover, if investment is positive, the weight of a new vintage of equipment in the capital stock is automatically higher than the older ones. We are aware that this property influences the shape of the marginal cost curve, but we do not consider it in what follows. For sake of simplicity and without any substantial consequence on the outcome, we assume that the labor productivity is uniformly and continuously distributed between two bounds, q_{min} and $q_{max} = (1 + \lambda)q_{min}$ where $\lambda \geq 0$ is related to the technical progress. More precisely, we assume that the labor productivity can be written as a decreasing function of the rate of capacity utilization, that is:

$$q(u) = [1 + (1 - u)\lambda]q_{min} \tag{2}$$

where u is restricted to the interval $[0, 1]$. This restriction, which is generally not taken into account, is here necessary because of the capital heterogeneity.

2.2. *Mark-up pricing and income distribution*

The labor being supposed to be homogeneous, there is a unique monetary wage, w.[4] So, at the macroeconomic level, the marginal cost, $w/q(u)$, is increasing with the rate of capacity utilization (see Figure 1). In this simple model, no overhead cost is assumed.

Prices are set through a mark-up procedure. In accordance with the neo-Kaleckian approach, the rate of mark-up to depend from both the degree of monopoly and the bargaining power of workers. The mark-up is therefore exogenous in the sense that it is not impacted by the level of the rate of capacity utilization.

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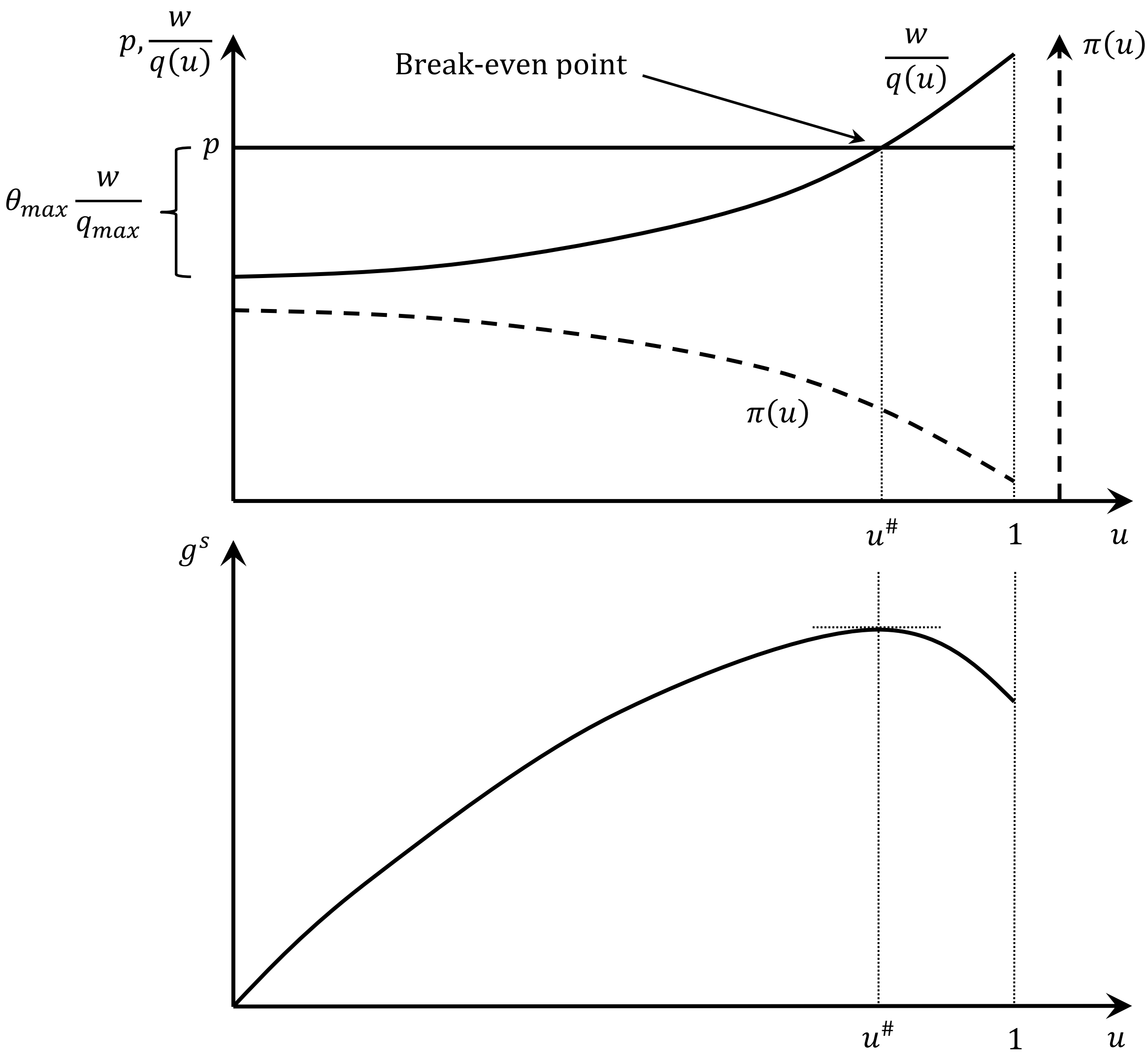
were higher than those of others; then, when the industry's level of output was low, production might be predominantly by the low-cost firms, but as the industry's output level expanded sharply under increased demand these firms would be unable, in the short run, to expand output proportionately with demand and the high-cost firms' output share would rise. Thus, marginal cost in each industry (exclusive of any rents) would rise with output" (p.191-192).

[4] See Bowles and Boyer (1990, fn.6) who suggest instead to relax the wage uniformity assumption if firms differ in their technology.

Figure 1. Marginal cost, price, profit share at the macroeconomic level (top); and the savings function (bottom).



Moreover, and this will have its importance later, this rate is set by the price-leaders (Lavoie, 2014, p.164-5), which are here the most efficient firms. More exactly, to simplify, it is assumed that the firm with the greater labor productivity (q_{max}) set its own mark-up θ_{max}. The resulting price level is given by:

$$p = (1 + \theta_{max})\frac{w}{(1+\lambda)q_{min}} \tag{3}$$

Alternatively, the real wage is given by:

$$\frac{w}{p} = \frac{(1+\lambda)q_{min}}{1+\theta_{max}} \tag{4}$$

It is clear, then, that a decrease in θ_{max} implies a rise in the real wage.

Only the most efficient firm get θ_{max}. As a consequence, a higher rate of utilization at the macroeconomic level goes along with the use of additional, less efficient equipment, which yield a weaker rate of mark-up, $\theta(u)$. Actually, this rate of mark-up can be calculated from:

$$p = [1 + \theta(u)] \frac{w}{q(u)} \tag{5}$$

Substituting p and $q(u)$ and rearranging, it comes that:

$$\theta(u) = \theta_{max} - (1 + \theta_{max}) \frac{\lambda}{1+\lambda} u \tag{6}$$

A special attention must be given to the rate of capacity utilization, $u^{\#}$, at which $\theta(u) = 0$, that is:

$$u^{\#} = \frac{\theta_{max}}{1+\theta_{max}} \frac{1+\lambda}{\lambda} \tag{7}$$

As a firm (or plant, or plant segment) is characterized by a constant marginal cost (that is equal to the average cost), two cases occur. Every profitable firm is located on the left of $u^{\#}$: its mark-up is positive and constant whatever the quantity it produces up to its full capacity. On the contrary, every unprofitable firm is located on the right of $u^{\#}$: it faces a negative mark-up whatever its level of production. This rate of capacity utilization, $u^{\#}$, therefore relates to the 'macroeconomic break-even point'.

Note that a necessary condition for this break-even point to be lower than full capacity at the macroeconomic level (i.e. $u^{\#} < 1$) is:

$$\lambda > \theta_{max} \tag{8}$$

Note also that the break-even point is the lower, the lower the rate of mark-up in the most efficient firm (θ_{max}) or the higher the technical progress parameter λ.

A central consequence of the above assumptions is that the profit share becomes endogenous. Actually, the profit share associated with the j^{th} equipment that generates $\theta(u)$ is:

$$\pi_j(u) = \frac{\theta(u)}{1+\theta(u)} \tag{9}$$

with, according to (7) , $\pi_j(u) = 0$ for $u = u^{\#}$. Substituting $\theta(u)$, it comes that:

$$\pi_j(u) = 1 - \frac{1+\lambda}{(1+\theta_{max})[1+(1-u)\lambda]} \tag{10}$$

The whole profit share is then given by:

$$\pi(u) = \frac{1}{u}\int_{i=0}^{u} \pi_j(i)di \tag{11}$$

which gives, after calculation:

$$\pi(u) = 1 + \frac{1+\lambda}{(1+\theta_{max})\lambda u} \ln\left(1 - \frac{\lambda}{1+\lambda}u\right) \tag{12}$$

where the logarithmic term is negative. The derivative:

$$\frac{d\pi(u)}{du} = -\frac{1}{u}\left[\pi(u) - \pi_j(u)\right] \tag{13}$$

being negative, the profit share is a decreasing function of the rate of capacity utilization (the dashed curve in Figure 1) because a rise in u involves the use of less efficient, less profitable equipment. Note that the mark-up set by the most efficient firm (θ_{max}) remains unchanged and that the endogeneity of the profit share is only due to the technical conditions of production in the economy. Our explanation therefore departs from other existing approaches, such as the Cambridge School in which the profit share adjusts to clear the goods market. Besides, the profit share increases with u in the Cambridge's approach while it is the opposite in our model.

It can also be checked that $\pi(u)$ decreases with respect to the λ parameter, which just reminds that firms' margins are lower the lower is their relative efficiency. Therefore, high discrepancies in efficiency entail high differences between the rates of mark-up and then a low profit share in the aggregate.

Conversely, if $\lambda \to 0$, every firm faces the same rate of mark-up (θ_{max}) so that the profit share is equal to $\theta_{max}/(1+\theta_{max})$, which is independent from the rate of capacity utilization u. This corresponds to the usual assumption regarding the marginal costs constancy.

2.3. Production decision

Regarding the production decision, we take over the usual neo-Kaleckian assumption according to which output is adjusted to meet the demand of goods. However, we add a restriction: production must be profitable, so that firms do not produce if the marginal cost exceeds the price level.

Of course, one can argue that some firms (or plants, or plant segments) continue to produce, even with negative profits, to keep their customers hoping for better days. However, one can also argue that some plants shut down while the profitability is still positive, which makes it possible to redirect their resources towards more lucrative activities. Our aim here is not to know the level of profitability at which firms stop producing. It is to claim that such a level exists. For sake of simplicity, we assume that it corresponds to the break-even point.[5]

2.4. *Investment and savings*

The above assumptions are included in a very basic, neo-Kaleckian model. On the first hand, firms' desired capital accumulation depends partly on the average expectation of the secular rate of growth (subject to animal spirits), as perceived by the managers of firms. It also depends on the gap between the actual rate of capacity utilization and the normal (or desired) rate of capacity utilization ($u_n < 1$) from the entrepreneurs' point of view. We thus have:

$$g^i = \frac{pI}{pK} = \gamma + \gamma_u(u - u_n) \tag{14}$$

where γ_u is positive.

On the other hand, wages are supposed to be fully consumed whereas profits are supposed to be partly saved. The desired rate of growth of savings, net of the rate of depreciation δ, is then given by:

$$g^s = \frac{S}{pK} = s_\pi[\pi(u)u - \delta] \tag{15}$$

[5] Yordon (1987, p.596) would have challenge our approach, arguing that firms may counterbalance higher labor costs by lower transportation costs. However, such remark is off topic in a model where the transportation costs are not explicitly included. An enriched model including the two costs would have produce similar outcomes than ours.

where s_π corresponds to the propensity to save out of profits.[6] The only originality is due to the endogeneity of the profit share. While the slope of g^s is usually constant in the plane (u, g^s), it now depends on the rate of capacity utilization:

$$\frac{dg^s}{du} = s_\pi \left[\pi(u) + \frac{d\pi(u)}{du} u\right] \tag{16}$$

which, substituting the derivative (13), can be rewritten:

$$\frac{dg^s}{du} = s_\pi \pi_j(u) \tag{17}$$

Obviously, this derivative is zero if $\pi_j(u) = 0$ that is at the break-even point ($u = u^\#$). It can also be checked that the second derivative is negative. Consequently, g^s is an inverted U-shaped curve that reaches its peak at the rate of capacity utilization corresponding to the break-even point, that is $u^\#$ (see the bottom of Figure 1). It can also be checked that:

$$\frac{dg^s(u^\#)}{d\theta_{max}} = \frac{s_\pi(1+\lambda)\ln(1+\theta_{max})}{\lambda(1+\theta_{max})^2} > 0 \tag{18}$$

In other words, the higher the rate of mark-up on the more efficient equipment, the higher both the break-even point and the rate of growth of desired savings, g^s.

3. Model resolution

The goods market equilibrium condition rests on the equality between desired investment and desired savings. Combining g^i and g^s, the equilibrium rate of capacity utilization is:

$$u^* = \frac{\gamma - \gamma_u u_n + s_\pi \delta}{s_\pi \pi(u^*) - \gamma_u} \tag{19}$$

Substituting $\pi(u^*)$ leads to a transcendent equation whose solutions exist but cannot be written analytically.[7] We therefore make use of graphical representations.

Note previously that, as it has been underlined, the profit share is independent from u if $\lambda \to 0$. In that case, every firm faces the same rate of mark-up (θ_{max}), and a fall in θ_{max} unambiguously implies a rise in u^*, which is the usual outcome of neo-Kaleckian models.

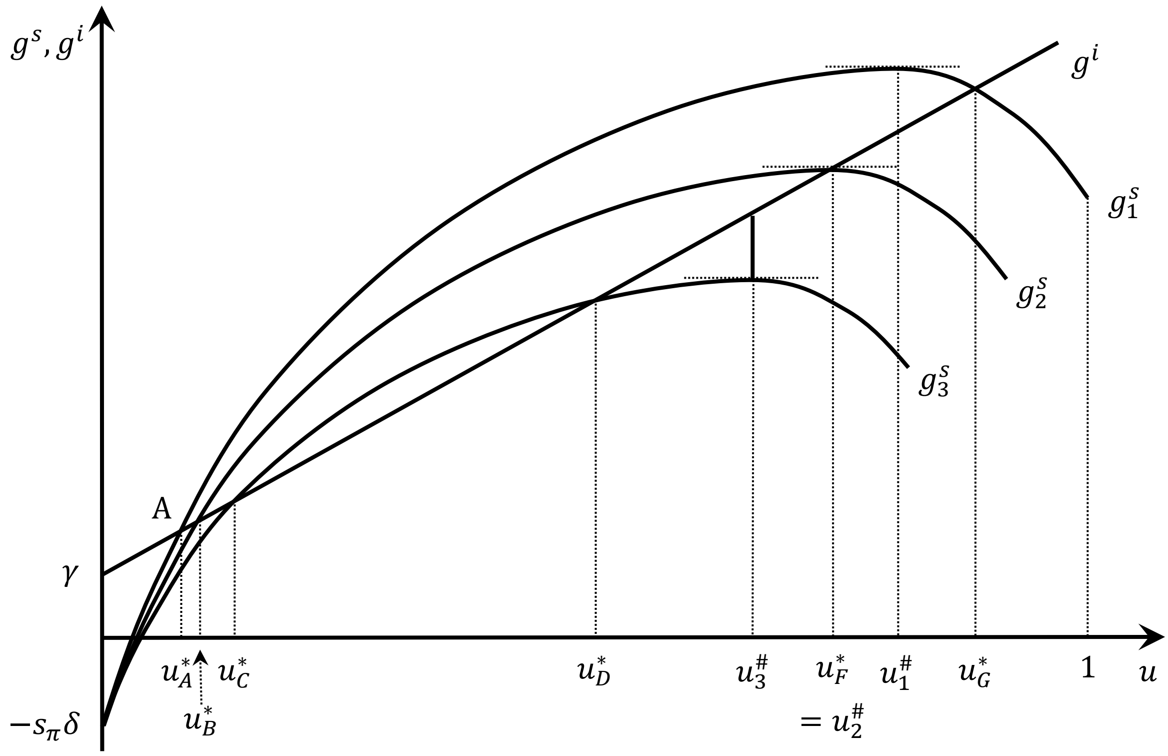
[6] The model could easily be made more realistic (including, for instance, the normal rate of capacity utilization in the investment function or the rate of capital depreciation in the savings function), but with no qualitative effect on the model outcomes.

[7] Actually, the form of the equation to be solved is $Au^* + B\, ln[1 - Cu^*] = D$.

3.1. Equilibrium and disequilibrium configurations

Because both savings curve is an inverted U-shaped curve and its intercept ($g^s(0) = -s_\pi\delta$) is lower than the intercept of the investment curve ($g^i(0) = \gamma$), at least five different cases must be distinguished. To avoid multiple figures, these five cases are depicted in Figures 2a and 2b assuming different investment curves. Moreover, for the discussion to be useful, we assume that the economy as a whole does never reach full capacity, a constraint that will be reintroduced later.

Figure 2a. Equilibrium and disequilibrium configurations.



In the first case, the peak of g_1^s is above the g^i curve, i.e. $g_1^s(u_1^\#) > g^i(u_1^\#)$. So there are two goods market equilibria so that $u_A^* < u_G^*$. However, firms do not have interest to produce more than the break-even point $u_1^\#$. The solution u_G^* is therefore unattainable. Besides, the Keynesian stability condition is fulfilled for u_A^*: the slope of g_1^s being higher than that of g^i in point A, savings reacts more strongly than investment to a change in the rate of capacity utilization. The adjustment mechanisms therefore bring the economy to its stable equilibrium, u_A^*. Actually, assume, for instance, that firms expect that the economy will converge to the break-event point $u_1^\#$. They rationally decide to accumulate $g^i(u_1^\#)$. However, this investment expenditure is financed with an amount of savings that is achieved at a lower level of rate of capacity utilization, $u < u_1^{\#}$. Firms respond to this lower rate of capacity utilization by reducing their investment, a change that entails a further decline in savings, etc. The mechanism stops when $g_1^s(u) = g^i(u)$, i.e. for $u = u_A^*$. Note that, although θ_{max} remains unchanged during this process, the profit share increases because the fall in u is accompanied by the concentration of the production in the most efficient firms.

The second case corresponds to a situation in which the leading firm has set a lower rate of mark-up than in the first case. It results in lower a lower profit share (whatever the rate of capacity utilization), hence a decline in both the savings function and the break-even point. In Figure 2a, g_2^s is drawn so that its peak corresponds to a point of intersection with the investment curve, i.e. $g_2^s(u_2^{\#}) = g^i(u_2^{\#})$. The firms can therefore reach u_F^*. However, this equilibrium point is unstable: any deviation in the rate of capacity utilization below u_F^* entails adjustment mechanisms that drive the economy to the stable equilibrium corresponding to u_B^*.

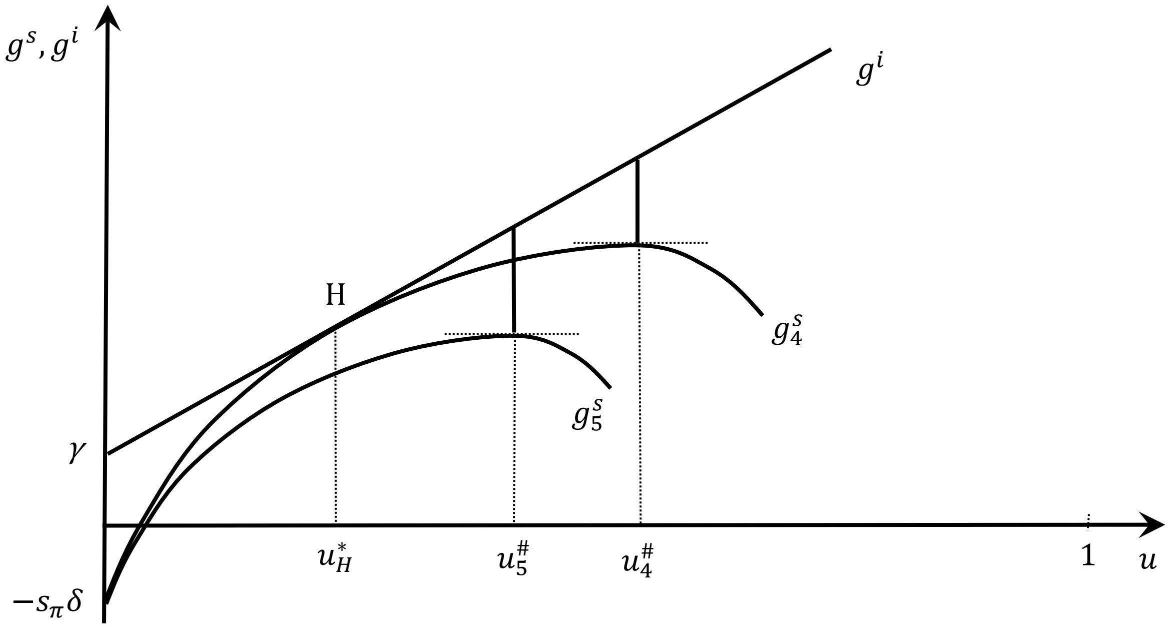
The other cases occur if the peak of g^s is below the g^i curve, i.e. $g^s(u^{\#}) < g^i(u^{\#})$. The third case illustrates the consequences of another fall in the rate of mark-up bargained by the leading firm. As previously, the lower equilibrium, u_C^*, is stable whereas the higher one, u_D^*, is unstable because the Keynesian stability condition is no longer fulfilled. Indeed, a small deviation above u_D^* implies a destabilizing adjustment mechanism: the higher value of u results in a rise in both investment and savings. However, the former is higher than the later, then a growing excess in aggregate demand and a goods market that diverges from its equilibrium. Yet, this destabilizing mechanism encounters a boundary. It could be given by full capacity for the economy as a whole ($u = 1$), but, in Figure 2a, it is given by the break-even point ($u_3^{\#}$): each rise in the rate of capacity utilization goes along with the use of less efficient equipment, yielding a lower mark-up. The mechanism stops when production is no longer profitable, i.e. when the mark-up becomes negative. It results in the goods market disequilibrium with an aggregate demand is in excess over aggregate supply, the desired investment being greater than the desired savings. In the short run, assuming exogenous prices (i.e. a given value for θ_{max}), this disequilibrium is solved either by a depletion of inventories or by rationing investment or consumption expenses. The ensuing 'equilibrium' point is located somewhere on the solid vertical segment between $g_3^s(u_3^{\#})$ and $g^i(u_3^{\#})$ in Figure

2a. This corresponds to a short-run position of rest. The analysis of the long-run reactions is postponed to a following section.

In the fourth case (Figure 2b), there is only one equilibrium, u_H^*, corresponding to the point of tangency between g^s and g^i. This is a semi-stable solution. Indeed, the adjustment mechanisms bring to u_H^* if we start from a lower rate of capacity utilization because of the Keynesian stability condition. Conversely, however, starting from a higher rate, u is taken away from u_H^*, up to the break-even point ($u_4^\#$) where there is an excessive aggregate demand, as in the previous case.

Eventually, g^s can be always lower than g^i. There is no goods market equilibrium whatever the rate of capacity utilization. The adjustment mechanisms drive once again the economy to the break-even point ($u_5^\#$).

Figure 2b. Equilibrium and disequilibrium configurations (continuing).

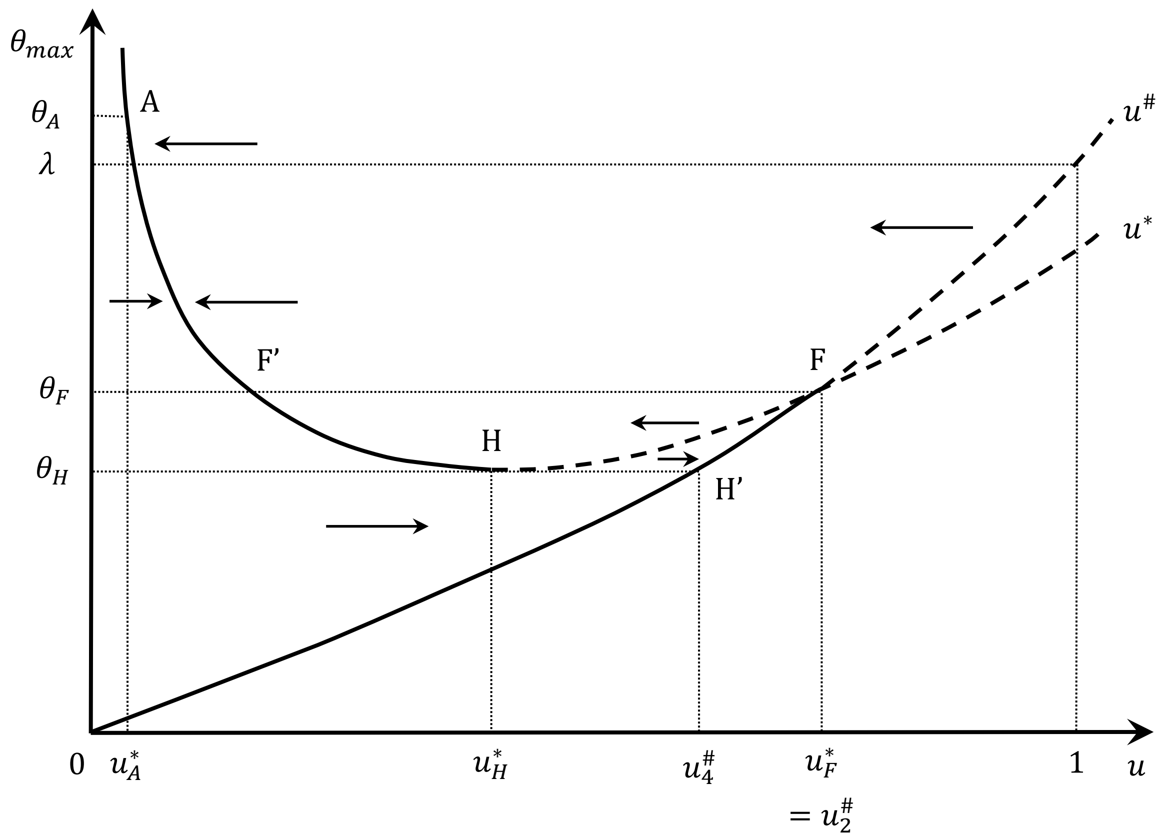


3.2. <u>The impact of real wage changes on economic activity</u>

The comparative statics resulting from the different values of θ_{max} are drawn in Figure 3. The increasing curve is the locus of the break-even points, $u^\#$. It shares the plane in two areas, one where profits are positive (above the curve), and the other which is unattainable since profits are negative (below the curve). In addition, let us remind that $u^\# < 1$ if $\theta_{max} < \lambda$.

The U-shaped curve is the locus of the goods market equilibria, u^*. The equilibria on the decreasing part of the u^* curve (solid line) are stable because they fulfil the Keynesian stability condition (see the arrows indicating the direction of the dynamic adjustments of the rate of capacity utilization in response to the pressure of excess supply, above the curve, or excess demand, below the curve). Conversely, the equilibria on the increasing part of the u^* curve (dashed line) are unstable. Point H corresponds to a semi-stable equilibrium. [8]

Figure 3. The value of the rate of capacity utilization according to that of θ_{max}.



Interestingly, the consequences of a change in θ_{max} differ depending to the direction of this change. Starting from a high level of θ_{max}, for instance θ_A, the rate of capacity utilization is rather low (u_A^*). The regime demand is then wage-led: as long as θ_{max} is

[8] The theoretical foundations of the U-shaped curve (i.e. the endogeneity of the profit share ensuing from technical differences among firms) are of course distinct from those that produce a similar shape. In Marglin and Badhuri (1990, p.170), for instance, the U-shaped curve results from the assumption that the profit share affects the investment function with a sensibility that depends on the rate of capacity utilization.

higher than θ_H, a decrease in θ_{max} goes along with a rise in the rate of capacity utilization on the decreasing part of the u^* curve.

However, as soon as θ_{max} falls below θ_H (a situation that can be illustrated by the g_5^S in Figure 2b), the Keynesian stability condition is no longer fulfilled. There is therefore a discontinuity in the adjustment dynamics, resulting from a destabilizing mechanism, which stops when it hits the break-even point: the pressure of excess demand generates a higher economic activity, then the use of less efficient equipment, which involves a fall in both the average rate of mark-up and the profit share, which fuels aggregate demand, etc. The mechanism only stops when the rate of mark-up on the less efficient equipment is negative so that additional production becomes unprofitable. The ending situation is stable in the short run, i.e. for a given value of the other parameters. It can be considered as 'equilibrium', in the meaning of a position of rest, whereas it corresponds to goods market disequilibrium. We will come back on this issue in a subsequent section.

Eventually, a further decrease in θ_{max} involves a lower break-even point. It therefore results in a fall in the rate of capacity utilization. The model reacts as if economy were profit-led: while the goods market suffers from an excess in demand (accordingly with a wage-led demand regime), firms diminish their production to avoid a drop in profits. The too high level of real wages directly dissuades some of them to produce. In the profit-led demand regimes proposed by post-Keynesians, in contrast, the fall in production results from the decrease in aggregate demand caused by a drop in investment expenditures.

In summary, the path followed by the successive adjustments to the decrease in θ_{max} (or, which is equivalent, to the rise in the real wage) start from A to H, then H', to finish at the origin, 0.

Now, what happens if we start with a low value of θ_{max}? The 'equilibrium' is near the origin of Figure 3, on part of the $u^{\#}$ curve in solid line. Therefore, the economic activity is profit-led and it suffers from an excess in aggregate demand. A rise in θ_{max} (i.e. a fall in the real wage) results in an increase in the rate of capacity utilization because due to the increase in the break-even point. This dynamics continues until point F, which corresponds to the higher level of production that can be reached in the short run. Besides, it is a point where the excess in demand has vanished so that the goods market is now balanced.

Then, an additional increase in θ_{max} leads to a discontinuous adjustment: the break-even point is enhanced, but there is now an excess in goods supply as the rise in investment is lower than the rise in savings. Therefore, the equilibrium shifts towards the decreasing part of u^* curve where the rate of capacity utilization is much lower than u_F^*. Actually, every little fall in production (in order to reduce the excess supply) involves stopping the use of the less efficient equipment. This implies an increase in both the average rate of mark-up and the profit share, which drops aggregate demand and restore the excess supply, etc.

From there, any rise in θ_{max} results in an additional decline in the rate of capacity utilization, in accordance with the usual outcome of the wage-led models.

In summary, the path followed by the successive adjustments to the rise in θ_{max} (or, which is equivalent, to the fall in the real wage) is not symmetrical to that of a fall in θ_{max}. It start from the origin (0) to F, F', A, and continues to the top of the decreasing part of the u^* curve.

3.3. *The role of embodied technological progress*

Our model rests on the assumption of a capital stock being composed by equipment of different vintages because of an embodied technological progress (λ). The role of this technical progress can be illustrated by comparing the locus of the stable equilibria (u^*) and break-even points ($u^{\#}$) for different values of λ.

The curves in solid line in Figure 4 correspond to a relatively high rate of technical progress, λ_2. The situation is quite similar to that which was analyzed in the previous section and Figure 3, except that the locus of stable break-even points now intersects the full capacity limit of the whole economy ($u = 1$) at point B. The economy therefore remains at full capacity whatever the value of the bargained rate of mark-up θ_{max} between θ_A and θ_B. Besides, it is wage-led if $\theta_{max} > \theta_A$ and profit-led if $\theta_{max} < \theta_B$.

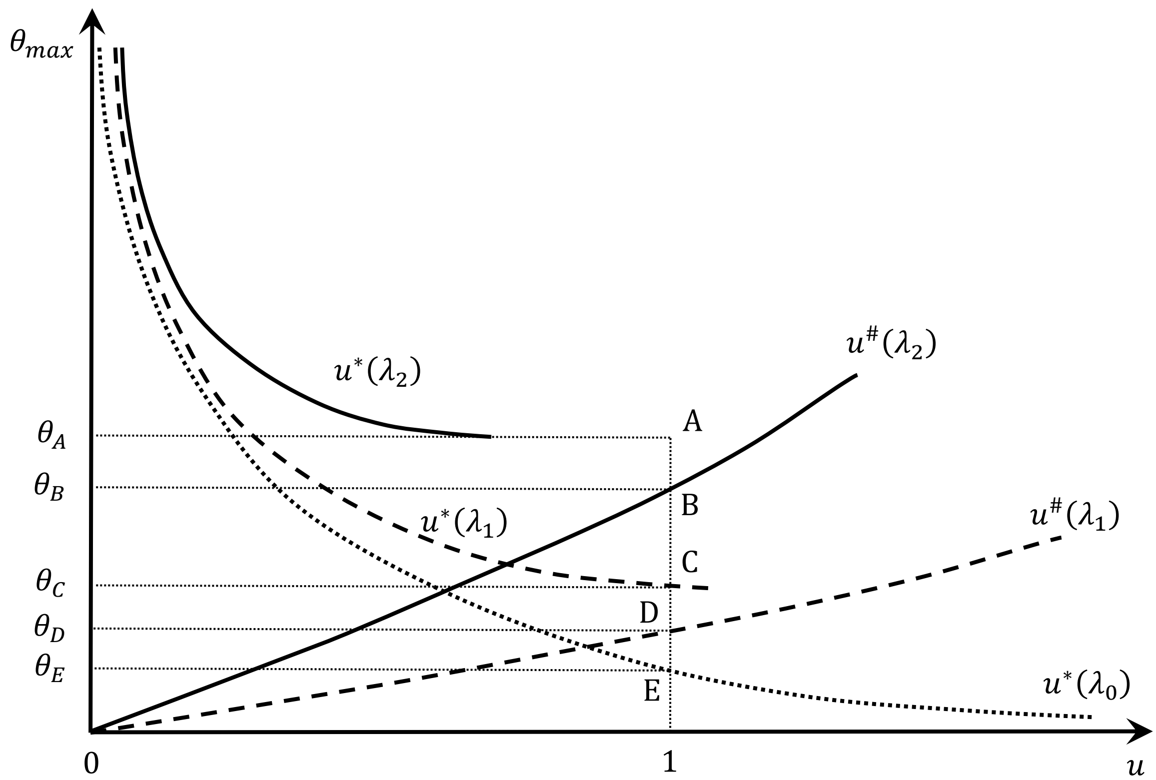
With a lower rate of technical progress, both curves are subject to two modifications: they rotate downward in the clockwise direction, and they are stretched towards the right so that higher values of u can potentially be reached.

Assuming $\lambda_1 < \lambda_2$ in Figure 4, both curves intersect the limit of full capacity, respectively at points C and D. Once again, the economy can be wage or profit-led, depending on the value of θ_{max}, except between θ_C and θ_D where it reaches full capacity.

For lower values of λ, both curves continue their downward rotation. Eventually, if $\lambda_0 = 0$, the $u^{\#}$ curve vanishes as it converges towards the horizontal axis while the u^* curve takes an hyperbolic shape. Under this assumption, the model is brought back to the canonical configuration according to which the economy is wage-led whatever the value of θ_{max}, provided that it is not at full capacity (if $\theta_{max} < \theta_E$).

In summary, and unsurprisingly, in an economy with significant productivity gaps, higher wages may cause profit losses on the least efficient equipment, resulting in a lower level of production as in an profit-led regime.

Figure 4. The role of labor productivity gains ($\lambda_2 > \lambda_1 > \lambda_0 = 0$).



3.4. *From short-run disequilibria to long-run adjustment mechanisms*

One of the main issues at stake is that the 'equilibria' located on the $u^{\#}$ curves correspond to aggregate demand excess in the goods market. They can be considered as being stable in the short run, i.e. as long as the behaviors of both agents and markets remain unchanged. The necessary accounting identity of receipts and expenses is therefore achieved either by a depletion of inventories, or by rationing investment or consumption.

In the long run, however, inventories vanish and one can expect that rationed agents adjust their behavior. A solution should be to allow the endogenous adjustment of an exogenous parameter. Unfortunately, none of the options included in the model bring to a conclusive, satisfying answer.

We could first consider a change in the capitalists' behavior, assuming that they get use to forced savings so that they finally decide to adjust their propensity to save (s_π) upwards. This adjustment occurs in the right direction as it increases the slope of the g^s curves in Figure 2 (note, however, that the break-even points are not impacted; see equation 7): therefore a drop in the demand excess that are represented by the vertical segments in bold, between g^s and g^i, at some break-even points ($u_3^\#$, $u_4^\#$, and $u_5^\#$). Nevertheless, the assumption that regular forced saving becomes a desired behavior lacks of theoretical as well as empirical foundations.

We thus look to another possibility relating to the investment behavior. In the case of a demand excess, firms are usually assumed willing to raise their investment. It would correspond to an increase in the γ parameter so that the g^i curve moves upward in Figure 2. Such shift clearly worsens the disequilibrium because the increase in investment fuels aggregate demand.

However, it is not clear whether the excess demand generates a rise or a decrease in γ for many reasons. On the one hand, the investment expenditure being already rationed, firms might react by reducing the value of γ. Nonetheless, as for forced savings, this assumption lacks of theoretical and empirical foundations. On the other hand, according to the 'Harrodian investment function' (see, for instance, Lavoie, 2014, p.378),[9] firms should adjust their expected secular rate of growth (γ). However, while the macroeconomic rate of capacity utilization is comprised between 0 and 1, individual firms are in a binary situation: either they produce at full capacity or their produce nothing. As the former produce more than their desired rate of capacity utilization (u_n), they should increase the value of the γ parameter. Conversely, the later should cut the

[9] A simple formulation of the 'Harrodian investment function' is $\dot{\gamma} = \psi(u - u_n)$ with $\psi > 0$.

value of γ, except if they are aware of both the excess in demand and the lack of profitability of their own equipment.

As a consequence, it is not clear whether the resulting average value of γ increases or not. It is also not sure that the 'Harrodian investment function' provides the best representation of the managers' reaction since a low level of the rate of capacity utilization may result from opposite configurations: a weak demand, or a demand excess due to a lack of profitability. Moreover, it must be reminded that this function generates Harrodian, knife-edge instability so that the accurate specification deserves more attention as well as its implications on the model stability.[10] Finally, the combination of excess in demand and unprofitability for no producing firms leads to another possible adjustment, that of the rate of capital depreciation δ.

Another possibility, which can depict a similar process than the Schumpetarian creative destruction, lies in an endogenous rise in the capital depreciation δ: because the idle capital is unprofitable, it should be more quickly replaced by firms. Such change would cause a downward shift in the intercept of the g^s curve (see Figure 5). Taken alone, the disequilibrium worsens since the g^s curve moves in the wrong direction. However, the rise in δ should go together with a drop in the number of the equipment vintages, therefore a fall in the λ parameter (the efficiency gap between the older and the newer equipment is narrowed). As a result, the rates of mark-up decrease more slowly for each rise in the rate of capacity utilization. The slope of the g^s curve is therefore higher than before. In addition, consistently with (7), the break-even point is also higher.[11]

Different configurations may result from the combination of these two changes. That of Figure 5 is drawn assuming that the biggest effect relates on the change in λ. Starting from the two solid line curves (g^s and g^i), the initial demand excess corresponds to the vertical segment [AB]. The question at stake is: by how much should δ be decreased (and λ be increased) to restore the goods market equilibrium? If it increases from δ_1 to δ_2, an equilibrium appears at point C, but the stability conditions do not make it possible to reach this point. The economy is stuck at point D with a remaining demand excess.

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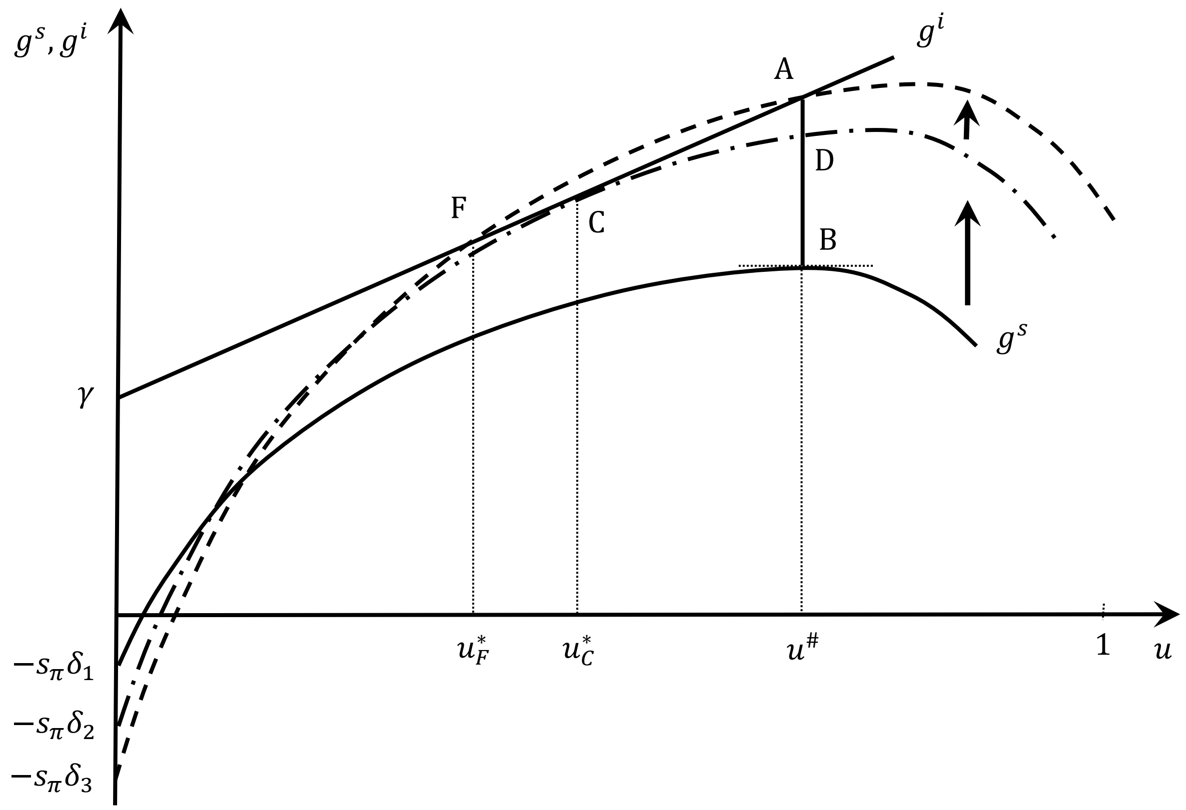
[10] Note, however, that this Harrodian instability can be offset if the long-run rate of economic growth is given by the exogenous rate of growth of an autonomous component of aggregate demand, an outcome that has been highlighted by recent research on supermultiplier models (see, for instance, Allain (2015)).

[11] Let us remind that g^s turns back to a straight line with no break-even point if $\lambda = 0$.

The excess in aggregate demand vanishes if the δ parameter increases to δ_3. The goods market equilibrium is therefore restored at point B. Nevertheless, as pointed before, this equilibrium is unstable. Any deviation below $u^{\#}$ engages a downward adjustment that brings the economy to the stable equilibrium at point F. At this stage, we must recognize that such a discontinuous drop in the rate of capacity utilization is a further puzzle about the model's behavior in the long-term.

Eventually, a last mechanism may be considered, depending on a clearing price adjustment as in the usual Cambridge approach: the price level increases up to the restoration of the goods market equilibrium, a change that corresponds, in our model, to a rise in the rate of mark-up θ_{max} set by the most efficient firm. Graphically, this adjustment can be represented by the upward move of g^s in Figure 5 (the only difference is that δ now remains unchanged), the outcome being a stable equilibrium at point F. Nevertheless, the Cambridge approach is not consistent with the neo-Kaleckian assumption of a mark-up resulting both on the structure of competition on the goods market and on the bargaining power of labor.

Figure 5. The impact of an increase in δ combined with a decrease in λ.



3.5. *Is the eventuality of an aggregate demand excess in the short run empirically relevant?*

A last issue must be examined: a low value of θ_{max} resulting in a stable short-run situation given by a break-even point on the $u^{\#}$ curve corresponds to an excess in demand in the goods market. Is it a relevant outcome while looking at the contemporary developed economies? It seems that the answer should be negative. Actually, what country is facing a consumption or investment demand rationing today? Probably none.

At least three reactions can follow. The first one would be to take advantage of this irrelevant outcome to dismiss the model and the assumptions on which it is based. However, to be complete, such reaction would challenge the following questions: Are there situations in which firms cut production due to a lack of profitability? If the answer is positive, what are the ensuing macroeconomics properties? In addition, how works an economy with heterogeneous capital efficiency?

A second reaction is to argue that the capitalists' power is high enough to maintain θ_{max} at a level at which the economy equilibrates on the u^{*} curve. Even if theoretically possible, in practice the economy would never get to the $u^{\#}$ curve. As for the first reaction, a rise in labor costs would therefore never imply a cut in production because of lack of profitability.

Finally, a last reaction would be to concede that, despite its interest, the former intuition (that excessively high costs could lead to a fall in production) is hard to accommodate with the Keynesian approach. Actually, in orthodox economics, a slowdown in outcome caused by a rise in labor costs does not involve goods market disequilibrium because of the Say's law. Conversely, in a Keynesian model in which goods supply is supposed to adjust to demand, any obstacle in this adjustment generates theoretical complications. It may be necessary to deepen the analysis to propose solutions that are more satisfying.

A fruitful strategy should be to open the model to foreign trade,[12] with the possibility to clear the demand excess by imports. The formal development of such model is left for further research. However, one can already expect an interesting consequence: the outcome would be similar than in the post-Keynesian literature, but drown on an

[12] In the previous section, the issue was about the long-run adjustment mechanisms. Opening the model to foreign trade should change the outcomes in the short as well as in the long run.

opposite argument. Actually, a rise in labor costs may impede net exports in each approach: because domestic as foreign agents prefer to buy at a lower price according to the usual post-Keynesian approach (demand logic); because production is more profitable abroad according to the model here proposed (supply logic). The analysis of a model combining the two logics would therefore be of great interest.

4. Conclusion

The motivation of this article was to give some credit to the claim that production could be hampered by a rise in labor costs. This is an important issue for at least two reasons. Firstly, there is perhaps something right in this claim, which must be taken in consideration in the post-Keynesian theory. Secondly, the fact that this claim is neglected by post-Keynesians, even as an eventuality, may have a part in the difficulty to give a refutation that can be heard by skeptics.

In an attempt to combine the two approaches (wages as income and as labor costs), we therefore proposed an amended canonical neo-Kaleckian model including capital heterogeneity (because of embodied technical progress) so that the rate of mark-up differs from a firm to another. It is also assumed that firms facing a negative mark-up decide not to produce, despite coping with an effective demand.

The main outcome is the existence of an optimal income distribution at which the rate of capacity utilization is maximized. Indeed, an economy whose demand regime is fundamentally wage-led reacts as if it were profit-led above a certain level of real wages. In that case, despite its positive effect on aggregate demand, a rise in real wages then implies a fall in profitability and then a cut in economic activity.

However, this situation is also characterized by an excess in aggregate demand, which can be solved in the short run with a cut in inventories or a rationing in consumption or in investment. To restore a long-run equilibrium, a solution should be to allow the endogenous adjustment of an exogenous parameter. Unfortunately, none of the options included in the model bring to a conclusive, satisfying answer in the long run: the raise of the capitalists' propensity to save (s_π) lacks of theoretical foundations and it is not sure whether the managers reaction should lead to a rise or a fall in their expected secular rate of growth (γ); the rate of capital depreciation (δ) should rise endogenously, but the effect on the efficiency gap between firms (λ) must be made more explicit.

Another track would be to open the model to foreign exchange, so that the demand excess would be removed by a decrease in the net export. What is clear now is that the issue of long-run adjustments deserves more attention. It should be at the heart of future research.

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